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ABSTRACT

The program and abstracts of the presentations of the 1992 meeting of the Society for College Science Teachers are the topics of this report. Society officers are listed, a history of the society is provided, and membership information is given. The presentations reflect different topics in the teaching of college science. The abstracts of presentations include the presenter's address. Abstracts of regional meetings for the society are also given. (PR)

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ED 364 434

SOCIETY FOR COLLEGE SCIENCE TEACHERS

Programs and Abstracts

Volume 12, 1992

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PURPOSE OF SCST

To provide a forum for interdisciplinary interaction among teachers of science at all institutions of higher education

PROGRAMS AND ABSTRACTS
VOLUME 12
1992

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NSTA President: Lynn W. Glass, N156 Lagomarsino Hall, Iowa State University, Ames, IA 50011 (515/294-7006)

HISTORY OF THE SOCIETY

The need for such an organization was identified by a group of concerned individuals within the National Science Teachers Association (NSTA). Significant to their concerns was a lack of a forum through which college science teachers could interact in an interdisciplinary manner with their colleagues from other institutions. The Society for College Science Teachers (SCST) was established on March 24, 1979 in Atlanta, Georgia during the NSTA meetings by participants attending an NSF-sponsored program on undergraduate education.

In April, 1981, the SCST became an official affiliate of the NSTA. The merger provides for increased services for college science teachers in assisting them to reach their personal objectives as well as those of the profession.

STATE MEMBERSHIP CHAIRPERSONS

The following states lack membership chairs: ARIZONA, DELAWARE, HAWAII, IDAHO, INDIANA, IOWA, LOUISIANA, MAINE, OREGON, SOUTH CAROLINA, VERMONT and WEST VIRGINIA. To volunteer to serve your state, contact Brooke Pridmore, Clayton State College, Morrow, GA 30260.

ALABAMA: H. Wayne Shew, Division of Science and Mathematics Birmingham Southern, Birmingham, AL 35254

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CANADA: William J. Mullin, Dept. of Biology University of New Brunswick, Bag Service #45111, Fredericton, N.B., Canada E3B 6E1

GOALS OF SCST

Improvement in the teaching of college science courses via interdisciplinary interactions among teachers of college science.

Provision of a profession-wide identity for teachers of college science.

Promotion of a societal and cultural awareness of the significance of science to the modern world.

Sponsorship of appropriate projects such as local and regional conferences and workshops.

Promotion of collective self-interest.

BENEFITS

Conferences

During the spring of each year, convention programs and paper sessions are held as part of the NSTA Annual Convention. These meetings enable college science teachers to communicate with each other and to learn what is happening at other levels of science teaching. Regional and local SCST conferences have been organized for the exchange of ideas and experiences, and discussion of issues of local concern. Local conference highlights are summarized in the SCST Newsletter.

The Journal of College Science Teaching (JCST)

SCST members receive the JCST which is published by NSTA six times a year. It contains feature articles on issues and topics of interest to college science teachers, new college science approaches, editorials, news items, book reviews, abstracts of selected articles, equipment and new products information, reviews of instructional media, national and legislative perspectives on college science teaching, and advertisements.

SCST Newsletter

The SCST Newsletter provides a regular source of information about Society business, projects, and membership activities. It is a source for keeping up-to-date with the Society and new developments in college science teaching.

Committees

In recognition of the importance of local area efforts to whatever success SCST may achieve, several working committees were established in 1982 in order to provide for increased program direction as well as for increased member participation. A continuing evaluation of the appropriateness of such efforts has resulted in the present SCST committee structure:

- Advanced Undergraduate Courses
- High School/College Articulation
- Introductory Courses
- Science and Technology
- Liaison
- Membership
- Resources/Development

Society For College Science Teachers
Membership Application
for persons who are currently members of NSTA

Complete this application and send to the SCST membership chairman at the address given below. You will begin receiving Society newsletters and abstracts immediately. Upon your next renewal of NSTA dues, you will be billed for a joint NSTA/SCST membership. This amount is currently $60 per year. If you are not currently recieving the Journal of College Science Teaching with your NSTA membership, an additional journal charge will also apply.

NSTA membership number: _____

Expiration date of current NSTA membership if known: _____

Name: _____

Mailing Address: _____

_____

_____

Main teaching area: _____

Institution: _____

Mail completed application to:

Brooke M. Pridmore
Clayton State College
School of Arts and Sciences
Morrow, GA 30260

Society For College Science Teachers
Membership Application
for persons not currently members of NSTA

Joint NSTA/SCST $60* _____ or **SCST** alone $51* _____

_____Check enclosed

_____Please bill me

*add $8 for foreign mail

Name: _____

Mailing Address: _____

_____

_____

Main teaching area: _____

Institution: _____

Mail completed application to:

NSTA
Member Services
1742 Connecticut Ave NW
Washington, DC 20009

SCST MINIGRANT FUND

PURPOSE

The purpose of these funds is to support the goals of SCST through activities that promote awareness of the significance of science and improvement in the teaching of college science courses.

ACTIVITIES ELIGIBLE FOR SUPPORT

Conferences and Workshops at the local or regional level for college teachers of science

Public Lectures or Exhibits for teachers of science and/or the public

Research on College Science Teaching such as development of instruments and acquisition of data that promise to fulfill the purposes of this program

Publication of materials of interest to college teachers of science and/or the public

Projects in cooperation with other professional societies are eligible for partial support; stipends and salaries will not be supported.

APPLICATION PROCEDURE

Eligibility - Minigrant applications may be submitted by individual SCST members or by organizations. If the application is made by an organization, an SCST member participating in the proposed activity must be a signatory on the application.

Proposal Format - 300-500 word, typed and double-spaced narrative outlining: objectives of the project, description of project, evaluation criteria, timeline, and budget.

Proposal Submission - Proposals may be submitted at any time of the year and will be considered by the Executive Committee at its meetings in Fall and Spring. Proposals should be submitted in duplicate; one copy sent to the SCST President, the other to the President Elect.

Criteria for Selection
- —projects that fulfill purposes of the Minigrant program;
- —projects related to current needs and goals of SCST;
- —projects that promise long-term benefit;
- —projects with impact on a significant number of people.

Amount of Award - No single award shall exceed $500; the number of awards to be limited by the total amount budgeted for the current year.

PROJECT REPORT

A final report addressing the extent to which objectives of the project were met, impact and expenditure of funds should be submitted to the SCST Secretary-Treasurer within 30 days of the completion of the funded project.

PROGRAM

SOCIETY FOR COLLEGE SCIENCE TEACHERS
NSTA NATIONAL CONVENTION — MARCH 25-28, 1992, BOSTON, MA

BUSINESS MEETINGS AND SOCIAL FUNCTIONS

EXECUTIVE COMMITTEE MEETING
Thursday, March 26
8:30 AM - 12 Noon
Massachusetts Room, Marriott Copley Place Hotel

SCST PAST PRESIDENTS' BREAKFAST
Friday, March 27
7:00 - 8:30 AM
Massachusetts Room, Marriott Copley Place Hotel

COLLEGE LUNCHEON
Saturday, March 28
12 Noon - 1:30 PM
Vineyard Room, Marriott Copley Place Hotel

SCST ANNUAL BUSINESS MEETING
Saturday, March 28
3:30 - 5:00 PM
Harvard Room, Marriott Copley Place Hotel

SCST SOCIAL
Saturday, March 28
5:00 - 6:30 PM
Harvard Room, Marriott Copley Place Hotel

COLLEGE LUNCHEON

Saturday, March 28, 1992
12:00 noon - 1:30 pm

Join colleagues from 2- and 4-year colleges and universities in an informal setting over lunch. The luncheon will conclude with brief talks:

"A Time of Ferment, A Time of Change"

Forces in society are creating change in college science eduction. Come hear about new developments in curriculum, instruction and research.

Honoring the memory and achievements of Marjorie H. Gardner, formerly Director Lawrence Hall of Science, University of California, Berkeley

Speakers: Bill Aldridge, Executive Director
National Science Teachers Association

Robert F. Watson, Director
Division of Undergraduate Science, Engineering, and Mathematics Education, National Science Foundation

cosponsored by NSTA College Division and SCST

CONTRIBUTED PAPERS

ALL SESSIONS WILL BE IN THE MIT ROOM OF THE MARRIOTT COPLEY PLACE HOTEL

SESSION 1

Wednesday, March 25
7:00 — 8:00 PM
Presider: Eleanor D. Siebert, Mount St. Mary's College

BARRIERS TO REFORMING SCIENCE EDUCATION AND STRATEGIES FOR OVERCOMING THEM
Mario Caprio, Suffolk Community College and William McIntosh, Delaware State College

SESSION 2

Wednesday, March 25
8:00 — 9:00 PM
Presider: Douglas Schamel, University of Alaska, Fairbanks

GROUP ASSESSMENT OF LOGICAL THINKING
Elizabeth Hays, Barry University

EXTENDING INQUIRY-BASED INSTRUCTION TO THE LECTURE HALL: OPPORTUNITIES AND OBSTACLES
Douglas Schamel, University of Alaska, Fairbanks

SESSION 3

Thursday, March 26
12:30 — 1;30 PM
Presider: William Kermis, Southwestern Oklahoma State University

CREATION SCIENCE: THE VIEW OF THE BIOLOGY MAJOR vs NONMAJORS
Michael Gipson, Oklahoma Christian University

HOW TO TEACH EVOLUTION IN THE LABORATORY:
INNOVATIVE LABORATORY EXPERIENCES AND DEMONSTRATIONS
Elliott M. Hartman, Jr. and Nathan Dubowsky
Westchester Community College

DO COLLEGE STUDENTS REALLY UNDERSTAND THE THEORY OF EVOLUTION?
Thomas R. Lord, Indiana University of Pennsylvania

SESSION 4

Thursday, March 26
2:00 -- 3:00 PM
Presider: Elliott Hartman, Westchester Community College

CYBERNETICS: A TECHNOLOGICAL LITERACY COURSE
Thomas T. Liao, State University of New York, Stony Brook

DESIGN INTERACTIVE SCIENCE SOFTWARE FOR YOUR OWN CLASSROOM
Ronald F. Pauline, Gannon University

HYPERMEDIA IN SCIENCE TEACHING
Peter Heywood, Brown University

SESSION 5

Friday, March 27
11:00 AM - 12:00 Noon
Presider: Rita Hoots, Yuba Community College

AN INTRODUCTORY CHEMISTRY PROJECT:
A MERGER OF CREATIVE WRITING AND DESCRIPTIVE CHEMISTRY
Kay M. Elsen, Mount Mary College

SUCCESSFUL APPROACHES TO TEACHING AN INTRODUCTORY SCIENCE COURSE
(NATURAL SCIENCE FOR TEACHERS: BIOLOGY)
Angela M. Sauro, Mount Mary College

EVOLUTION OF A FIRST-YEAR COLLEGE INTEGRATED CHEMISTRY/BIOLOGY CURRICULUM
Vin LoPresti and Fred Garafalo
Massachusetts College of Pharmacy and Applied Health Sciences

SESSION 6

Friday, March 27
12:30 AM -- 1:30 PM
Presider: Harold McKune, St. Joseph's College

ADDRESSING RETENTION THROUGH THE DEVELOPMENT OF A SCIENCE COMMUNITY, OR HOW DO YOU KEEP THEM IN LAB WHEN THEIR FRIENDS ARE AT THE POOL?
Eileen Gregory, Richard C. Jones and J. Thomas Cook
Rollins College

INTERACTIVE LEARNING IN GENERAL CHEMISTRY
Keith B. Kester, The Colorado College

A THEORY OF SCIENCE TEACHING
William H. Leonard, Clemson University

SESSION 7

Friday, March 27
2:00 -- 3:00 PM
Presider: Eileen Gregory, Rollins College

DINOSAURS: A CASE STUDY IN THE PHILOSOPHICAL ROOTS OF GOOD SCIENCE
Edward W. Scheer, Rollins College

THE TROPICS: A FUSION OF SCIENCE AND ART
Maura C. Flannery, St. John's University

SCIENCE AND ART IN AMERICA'S "TROPICAL RENAISSANCE"
Robert Hendrick, St. John's University

SESSION 8

Friday, March 27
3:30 -- 4:30 PM
Presider: Rebecca Halyard, Clayton State College

A FURTHER LOOK AT RELATIONSHIPS BETWEEN STUDENTS' LEARNING STRATEGIES AND THEIR SUCCESS IN HUMAN ANATOMY
Mary Jo Fourier and Pegi Denton, Johnson County Community College

MASTERY-BASED INDIVIDUALIZED INSTRUCTION OF A HUMAN PHYSIOLOGY COURSE
William J. Mullin, University of New Brunswick

AN ICAI SHELL FOR USE IN HUMAN PHYSIOLOGY COURSES
Yehudit J. Dori, Israel Institute of Technology
Jerome M. Yochim, University of Kansas

SESSION 9

Saturday, March 28
8:00 -- 9:00 AM
Presider: Duane Sea, Bemidji State University

PLANET EARTH AT RISK: AN INTERDISCIPLINARY LECTURE/LABORATORY COURSE FOR ADULT LEARNERS TAUGHT IN A WEEKEND COLLEGE FORMAT
Harold T. McKone, Thomas Malone, M. Claire Markham
Saint Joseph College

A COLLEGE/LOCAL SCHOOLS MODEL OF SUMMER RESEARCH FOR SCIENCE TEACHERS
Lazslo Baksay, University of Alabama

WRITING TO LEARN IN ORGANIC CHEMISTRY
Harold W. Pier, Utica College of Syracuse University

SESSION 10

Saturday, March 28
11:00 AM — 12:00 Noon
Presider: Laura Barden, University of Tennessee

SUCCESS IN THE STUDY OF GENERAL CHEMISTRY
Leonard C. Grotz, University of Wisconsin Center, Waukesha

THE REDESIGN OF A FRESHMAN BIOLOGY COURSE -- TWO YEARS LATER
Eileen Gregory, Rollins College

A COMMUNITY COLLEGE SCIENCE TEACHER'S VIEW OF THE UNIVERSITY SCIENCE PROGRAM FOR UNDERGRADUATES
Rita Hoots, Yuba College

A COLLEGE-LOCAL SCHOOLS MODEL OF SUMMER RESEARCH FOR SCIENCE TEACHERS

Laszlo Baksay
Department of Physics
University of Alabama
Tuscaloosa, AL 35487

We will describe a program funded through a grant from NSF's Teacher Enhancement. Twenty-four high school teachers of physics, geology, chemistry, and biology participated in research projects conducted by Union College faculty for eight weeks in 1989 and 1990. An important feature of the "hands-on" program was a teacher to faculty ratio of one to one. Teachers had the opportunity to become "junior" collaborators. Teachers were selected on the basis of some formal requirements, their willingness to learn, and the likelihood to benefit from the research experience. Schools had to make some commitments for support such as allocation of some funds for two years to buy equipment for classroom activities based on the teachers' summer experience. Ties established between college faculty and teachers, as well as follow-up activities ensured further college-school interactions.

BARRIERS TO REFORMING SCIENCE EDUCATION AND STRATEGIES FOR OVERCOMING THEM

Mario Caprio
Department of Biology
Suffolk Comm. Coll.
Selden, NY 11784-2899

William McIntosh
Dept. of Science Educ.
Delaware State College
Dover, DE 19901

Nathan Dubowsky
Biology Dept.
Westchester Comm. Coll.
Valhalla, NY 10595

This session is offered by the SCST Committee for Introductory Courses. A general discussion of the major obstacles confonting those seeking to initiate innovations in science education will introduce the topic. Following this brief foreword, the presenters will lead the participants as they develop a means for creating model introductory science literacy courses in chemistry, biology, earth science, and physics. The intent is to design new courses "from the ground up", to respond directly to the special needs of non-science majors, and to avoid having them be mere diminutions of existing majors' courses. We will, of course, not finalize the course designs here, but will only develop the means to that end. We will create the necessary working subcommittees, design a method by which they can work, arrange for their coordination, and set deadlines for their reports. in the end, and this will be about a year away (possibly longer), we will produce outlines for science literacy courses, along with bibliographic and other ancillary support materials. Participants who are unable to participate fully on one of the subcommittees will be able to join a mailing list to receive periodic updates, so they will be able to stay in communication with the project, if they wish to do so. The entire package developed at this session will be put in the form of a proposal to be delivered at the SCST Business Meeting later in the conference. The project will begin with the approval of that proposal. At its worst, this will be an interesting session during which participants will gain first-hand knowledge of the barriers to reform in science education and what is required to overcome them; at its best it might lead to a major contribution by SCST in the area of science literacy courses.

AN ICAI SHELL FOR USE IN HUMAN PHYSIOLOGY COURSES

Yehudit J. Dori
Dept. of Education in Technol. and Science
Technion, Israel Institute of Technology
Haifa 32000, Israel

Jerome M. Yochim
Dept. of Physiol. & Cell Biol.
University of Kansas
Lawrence, KS 66045

Intelligent computer assisted instruction software consists of four modules: expertise, tutorial, student model and inference. The expertise module handles the domain knowledge, the tutorial module consists of the instructional strategies, student's misconceptions and diagnostic rules. The student model module deals with the performance history of the individual student, and his/her learning deficiencies and needs. The inference module processes input from the student, interprets it, and directs the student to a learning path most suitable to his/her progress. We have developed several modules in the domain of human physiology - endocrinology, the digestive system, and the renal system, in which we have gained experience in learning strategies and their diagnosis. This has been done by a tool called Card Traversal Graph, built into the courseware, which monitors the order and duration of viewing screens by each individual student. Embedded quizzes and test barriers determine the exact topics in which the student has some deficiency. This model is now being generalized so that it will become a shell into which knowledge base of other modules can be inserted.

AN INTRODUCTORY CHEMISTRY PROJECT: A MERGER OF CREATIVE WRITING AND DESCRIPTIVE CHEMISTRY

Kay M. Elsen
Department of Chemistry
Mount Mary College
Milwaukee, WI 53222

One of the major educational movements which has been designed to integrate writing with all aspects of the college experience is often called "writing across the curriculum". College professors from all disciplines have recognized the importance of writing as a way of learning. Chemistry courses should not be excused from utilizing this valuable skill. In general chemistry courses professors are faced with the impossible task of covering all of the material included in their text. Often the sections dealing with descriptive chemistry are the first to be ignored and students are not exposed to the chemistry of individual elements. As a response to these challenges students in Chemical Principles II are asked to write a descriptive paper in which they discuss an element as an entry to The Miss Element Contest. This paper allows the students to be creative and also research a specific element. This presentation will compare a traditional research paper to this creative writing style. Student responses to this technique will also be illustrated.

THE TROPICS: A FUSION OF SCIENCE AND ART

Maura C. Flannery
Department of Computer Science, Math and Science
St. John's University
Jamaica, NY 11439

A wide variety of strategies has been used to make students aware of the environmental problems in the tropics. In this presentation, I propose still another approach: the use of art. A number of 19th-century American artists traveled in Central and South America and produced notable works of art based on their first-hand observations. Frederic Church and Martin Heade are two of the most prominent members of this group. Examples of their works can be used very effectively in teaching about tropical ecosystems. The lushness of rainforests is richly portrayed in such Church paintings as "The Heart of the Andes", in a way that is more moving than any present-day photograph. A Heade painting of a hummingbird and an orchid plant is a beautiful example to use in a discussion of symbiosis. Introducing such art into the science classroom serves several purposes. It forges links between art and science, shows how artists' perceptions can illuminate scientific concepts, and makes possible discussion of the artist's versus the scientist's view of nature. Using examples from 19th-century art has the further advantage of allowing for a comparison of the past and present states of tropical ecosystems.

A FURTHER LOOK AT RELATIONSHIPS BETWEEN STUDENTS' LEARNING STRATEGIES AND THEIR SUCCESS IN HUMAN ANATOMY

Mary Jo Fourier and Pegi Denton
Division of Science, Health Care and Math and Learning Strategies Program
Johnson County Community College
Overland Park, KS 66210

Four sections of Human Anatomy students (N=96) were the subjects in a study of the relationship between learning and study strategies or methods and success in Human Anatomy, as measured by semester grades. These students were administered the LASSI, Learning and Study Strategies Inventory, which had been designed to gather information from students regarding not only their learning and study practices, but also their attitudes. This presentation will discuss the procedures followed in the administration, self-scoring, interpretation of the student's profile, and recruitment of students for the College's Learning Strategies Program. This program provided intervention methods for those students appearing to be "at risk" on the basis of their profile. A short discussion of how this program works and its course offerings will be given. Results of this study will be presented which indicated that when any section of the new Strategy for Human Anatomy course was taken, semester grades were higher than those of students with similar profiles who did not avail themselves of the intervention course. On the basis of these results, this new course offering is being offered for the second time during spring semester 1992.

"CREATION SCIENCE" THE VIEW OF THE BIOLOGY MAJOR VERSUS NON-MAJORS

Michael Gipson
Department of Biology
Oklahoma Christian University of Science and Arts
Oklahoma City, OK 73136-1100

One hundred thirty students at a religiously affiliated liberal arts university were given pre-test and post-test questionnaires on issues related to evolution and the age of the earth. The results were compared with performance on exam questions dealing with natural selection, plate tectonics and the fossil record. There were significant differences in the views of majors versus non-majors, but little difference in their understanding of the concepts. Anecdotal evidence from interviews with biology majors from conservative religious backgrounds indicate considerable intellectual conflict within the students. Implications for teaching will be discussed.

THE REDESIGN OF A FRESHMAN BIOLOGY COURSE -- TWO YEARS LATER

Eileen Gregory
Department of Biology
Rollins College
Winter Park, FL 32789

Over a period of two years, the faculty at Rollins College have modified the lecture portion of the introductory biology sequence to enhance student learning and motivation. The format now being used is based on active learning theories and focusses on the utilization of class time to analyze and evaluate scientific concepts rather than the presentation of these concepts. Students come to class prepared to discuss the assigned reading material and spend at least half of the class time working in small groups on teacher generated questions and problems. The remainder of the time is spent answering student questions, working study guide problems or on informal oral quizzes. In addition, a minimum of twenty minutes per week is spent on student presentations of news items relating to biology. Group cooperative work is emphasized in all aspects of the course including group quizzes and presentations and collaborative rewriting of examinations. Assessment of this methodology has been very positive. Retention of students in biology has increased and teachers of advanced courses have reported an increase in student skills, especially in their ability to efficiently read a science text. Students also report increased motivation to study biology and continue to keep abreast of applications of the concepts learned in class.

ADDRESSING RETENTION THROUGH THE DEVELOPMENT OF A SCIENCE COMMUNITY OR HOW DO YOU KEEP THEM IN LAB WHEN ALL THEIR FRIENDS ARE AT THE POOL?

Eileen Gregory, J. Thomas Cook and Richard C. Jones
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The low retention rate of students in science is leading to a national crisis. At the college level introductory biology, chemistry and physics courses are major contributors to this problem. Many students entering college do not have sufficiently developed skills to succeed in these courses. Those that can rapidly adapt tend to continue while those who cannot leave the sciences. In an attempt to provide a support structure for these first year students, Rollins College has developed the Science Community Year (SCY). This program, open to all first-year students enrolled in mathematics and at least one laboratory science course, provides support through an integrative seminar, tutoring, field trips and other activities fostering the formation of a science community. One of the unique aspects of this program is the use of a Master Learner, a non-science faculty member who is a regular student in the same classes as the freshmen. In addition to serving as a model learner, the Master Learner conducts the weekly SCY seminar and serves as a conduit for communication between the students and faculty. Evaluation of the program is ongoing, but preliminary studies have shown it to be effective in maintaining an atmosphere of supportive camaraderie, increasing faculty dialogue on the nature of the science curriculum and encouraging and supporting redesign of the introductory courses.

SUCCESS IN THE STUDY OF GENERAL CHEMISTRY

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The question that continues to plague teachers of general chemistry is, "What is it that the good students in chemistry are able to do, that makes them successful in the study of chemistry, that the poor students are not able to do?" Until this question is answered, the teachers of general chemistry will not be able to conduct their courses in an efficient and effective manner. After 35 years of teaching general chemistry, and 22 years of very active research in chemical education, the author has concluded that the success factor in the study of chemistry is simply the ability to perform analytical reasoning. How the "in situ" research of the author has led to this conclusion will be presented. Also, how Bloom's hierarchy of cognitive processes and the use of "extrinsic" pedagogic research has led chemical educators astray will be discussed. Unfortunately, analytical reasoning ability cannot be developed in a short time frame. Therefore, the implications of this proposed success factor for the teaching of general chemistry will be examined.

HOW TO TEACH EVOLUTION IN THE LABORATORY
INNOVATIVE LABORATORY EXPERIENCES AND DEMONSTRATIONS

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State University of New York — Westchester Community College
Valhalla, NY 10595

The concept of evolution is often used as a unifying theme in introductory courses in the biological, earth, and space sciences. It should be one of the most dynamic and interesting topics encountered by students. This is not always the case. While evolution is easily presented in classroom discussions, there is a paucity of meaningful laboratory experiences and demonstrations that encourage students to explore the subject employing the scientific methods of problem-solving. Over the past several years, the presenters have taught courses in the origin and evolution of life at both the undergraduate and graduate levels. They have had the opportunity to develop and field test a wide variety of nontraditional, innovative laboratory experiences which encourage student participation in open-ended investigations. The presenters will demonstrate laboratory protocols which may be used to complement discussions of:

(A) spontaneous generation and chemical evolution
(B) history of the development of life on Earth
(C) extraterrestrial life forms

Sample written protocols will be provided.

GROUP ASSESSMENT OF LOGICAL THINKING

Elizabeth T. Hays
School of Natural and Health Sciences
Barry University
Miami Shores, FL 33312

The author will discuss her experience using GALT (Group Assessment of Logical Thinking) - a testing instrument developed in order to distinguish concrete and formal stages of development. The author will present results obtained in two groups of entry level college students.

SCIENCE AND ART IN AMERICA'S "TROPICAL RENAISSANCE"

Robert Hendrick
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In the mid-nineteenth century, landscape paintings were extremely popular with the American public, in part because they reflected a growing interest in the natural sciences in this country. At the same time, Europeans and Americans became fascinated with Latin America. Scientists and naturalists such as Alexander von Humboldt, Charles Darwin, and Louis Agassiz were drawn to the area on scientific expeditins. This fascination was also reflected in American art; in the period from the late 1830s through the 1870s, over thirty American painters traveled through Latin America and returned home to produce works that created what has been termed the "tropical renaissance". These two trends (the landscape painter as natural scientist and the interest in the American tropics) came together when Frederic Church, inspired by reading Humboldt and by recent scientific discoveries, went to South America and produced immensely popular paintings of the area's topography and flora. Other artists quickly followed his example. This paper presents the scientific and historical reasons behind this "tropical renaissance" by examining the paintings of Church, Martin Johnson Heade, Louis Mignot, Norton Bush, and others. It will also demonstrate how art can be used to illustrate the history of science.

HYPERMEDIA IN SCIENCE TEACHING

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Hypermedia software systems can provide users access to a corpus comprising text, photographs, diagrams, video sequences and three-dimensional models. Hypermedia fosters connectivity of ideas by allowing the student to explore a matrix of information in a non-linear fashion. The use of hypermedia in teaching cell biology will be described: it allows students to obtain a coherent understanding of cellular activities by drawing on information from microscopy, biochemistry, genetics, molecular biology, immunology, etc. Clearly, a similar approach is possible within other areas of science which also require a synthesis based on information obtained by different methodologies.

COMMUNITY COLLEGE SCIENCE TEACHER'S VIEW OF THE UNIVERSITY SCIENCE PROGRAM FOR UNDERGRADUATES

Rita Hoots
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Yuba College
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As a recipient of the University Partnership Program (UPP) Fellowship for 1990-91 funded by the Hughes Foundation, I spent the year observing and participating in undergraduate science courses at the University of California, Davis, The classes included the Biology Majors, some Biology GE as well as Chemistry and Physics GE offerings. I would like to offer my impressions of the difference in the educational goals, practices and learning expectations between the two undergraduate programs. These include observations on undergraduate science curricula, program goals, traditional teaching formats, and the student consumers; as well as summarized comments from selected interviewed university researchers and lecturers as to their thoughts on science education. The UPP was designed by the Division of Biological Sciences expresely to foster a close and continuing relationship between the community colleges and the university. The overriding goal is to encourage the transfer of biological science candidates from the two year colleges to the research institutions. By linking the faculty, connecting the programs, and fostering communication between the levels, students can be better prepared to make a successful transition. One aspect of this grant is to enable community college faculty development through exposure to new developments, technology, laboratory equipment, and access to research opportunities. The revitalized faculty, in turn, are expected to update colleagues, students, and programs.

INTERACTIVE LEARNING IN GENERAL CHEMISTRY

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The Colorado College
Colorado Springs, CO 80903

At Colorado College, General Chemistry is taught under our modular system in two blocks of 3 1/2 weeks duration. Class size ranges from 24-32 students. Seeking to promote higher order thinking and dialogue about chemical concepts, learning through teaching, and collaborative work on both problem solving and laboratory experiments, we divided the class into teams of three to four students. Reading, problem, and teaching assignments were given to each group. Class time consisted of question-asking by both groups and individuals; question-answering and explanations by both peers and instructors; collaborative problem solving; and minilectures by the instructor that either supplemented concept explanation in the text, or pulled things together. Different strategies for solving problems were welcomed and shared. Answers to problems were not provided until solutions were proposed. Emphasis was placed on obtaining a reasonable answer. Blackboard space was provided for each group. Laboratory work was done individually or in teams of two. Laboratory preparation and statistical analysis of results were done in groups. Student and instructor reaction to this format will be presented.

A THEORY OF SCIENCE TEACHING

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Clemson University
Clemson, SC 29634

Perhaps the most embracing theory in education is the principle of active learning. It is becoming clearer in educational research that learners who are actively engaged in the learning process are the most successful learners. A great deal of what is traditionally taught in secondary science is quite abstract. Certainly most theories in science are abstract concepts. Research in cognitive psychology is also beginning to find significant support for the following instructional hypotheses:
(1) Learners will benefit most from concrete learning experiences prior to their successfully understanding abstract science concepts; that is, lecture of an abstract nature and reading should follow, rather than precede, engaging activities. This hypothesis suggests that a productive learning sequence is probably (a) orientation, (b) hands-on investigation, (c) discussion, perhaps a little lecture, then (d) reading and working problems.
(2) Learners must reconstruct new knowledge of our culture as if it were entirely new to them. Most knowledge, if it is to be applied, cannot simply be imparted (poured into a student's head). Learners must interact with and reconstruct the concepts for themselves.
(3) Learners attempt to connect new conceptual development to their existing cognitive framework. This suggests that providing the student with a conceptual framework and advance organizers which fit onto the framework will allow the student to fit what is being learned into what is already known.

CYBERNETICS: A TECHNOLOGICAL LITERACY COURSE

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Technological literacy can be defined as the integration of five domains of knowledge for studying technological systems or socio-technological problems and issues. In courses offered by the Department of Technology and Society of SUNY at Stony Brook, we focus on the following five domains:

* technological systems operation and related engineering concepts
* related science concepts
* application of quantitative thinking
* relevant human factors and impacts
* relevant societal impacts

This paper will discuss the design and evolution of the most successful course that we offer for developing technological literacy for all SUNY at Stony Brook undergraduates. This course about modern communications technology, its design and use, has enrolled over 4,000 students in the past twelve years. Although many emerging systems such as HDTV, CD Audio, cellular telephones, voice recognition and synthesis, and bar codes are studied, only three central concepts are studied in detail. They are the study of analog signals, digital representation of signals and properties and uses of the electromagnetic spectrum.

EVOLUTION OF A FIRST YEAR COLLEGE INTEGRATED CHEMISTRY/BIOLOGY CURRICULUM

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Massachusetts College of Pharmacy and Allied Health Sciences
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For the past five years, we have been teaching our first-year chemistry and biology courses as an integrated natural science curriculum. This approach was initially implemented to encourage students to develop a more unified view of the natural sciences, and to assist us in mitigating the impact of the scientific knowledge explosion on survey courses. In this talk we will describe the evolution of both content and methodology in the integrated curriculum, and the influence of research in teaching and learning on this process. We will describe the unifying themes around which the curriculum is integrated, the use of operational definitions and tangible examples in introducing concepts, the choices involved in eliminating topics, the benefits and limitations of developing concepts from an historical perspective, and the methods we are employing to encourage the development of thinking skills and an interactive classroom format in the face of large classes and a growing number of non-native speakers. In addition, we will discuss the impact that explicit course integration has had on our ability to present the idea that biochemistry underlies but does not entirely define the nature of biological systems.

DO COLLEGE STUDENTS REALLY UNDERSTAND THE THEORY OF EVOLUTION?

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Indiana University of Pennsylvania
Indiana, PA 15705

A survey conducted recently by the Associated Press indicated that most people in this country believe that living things developed through evolution. Analysis of the questions used in the study, however, reveal that most of the respondents do not really understand what evolution is all about. Large numbers of people, for example, believe that acquired traits can be inherited. The study also found that the majority of the people supported the teaching of creationism along with evolution in the public schools. Although the poll was conducted on a large number of people, the academic level of the participants was not considered. One might predict that the higher the education level of the respondent, the greater the chance of them understanding the basic mechanisms of modern evolution. To find out, a survey was conducted on several hundred university students in western Pennsylvania. All of the participants indicated they had been taught the principles of evolution in high school, and most reported discussing evolution in several college courses. The study included an equal number of men and women and the four undergraduate years were equally represented. The survey indicated that nearly three quarters of the students believe in the modern theory of evolution. Interestingly, while most of the respondents know that natural selection was the mechanism of evolution, a surprisingly large number (about a third) thought that purposeful striving toward a more complex form was the mechanism. Furthermore, two thirds of the students thought that creationism should be taught along with evolution even though they acknowledged that this would bring religion into the classroom. The study concludes that, while education enhances one's understanding of evolution, most college students retain their kindred beliefs.

PLANET EARTH AT RISK: AN INTERDISCIPLINARY LECTURE/LABORATORY COURSE FOR ADULT LEARNERS TAUGHT IN A WEEKEND COLLEGE FORMAT

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Saint Joseph College
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Saint Joseph College, a predominately women's college, has recently developed a successful coeducational Weekend College Program for adult learners. To expand the science offerings in this new program, we have developed a lecture/laboratory course using the "Race to Save the Planet" video series as the focus. This course is an interdisciplinary study of the present state of planet earth (population, the atmosphere, water use and pollution, land development, and energy and natural resources). In addition, there is a social science component that addresses the tensions existing between environmental and economic concerns and discusses effective political processes. Among the requirements is a final paper in which the student proposes a specific plan for moving toward a sustainable society. Laboratory sessions involve monitoring air and water quality, energy conversion studies, and the examination of interactions among living things. The outcomes of this course will be discussed in terms of the special focus on the adult learner, on our novel weekend college format, and on our adaption of this course material to a more traditional audience and format.

MASTERY BASED INDIVIDUALIZED INSTRUCTION OF A HUMAN PHYSIOLOGY COURSE

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Reviews of the literature show that individualization leads to equal or better learning in what students often describe as a more enjoyable atmosphere. Learning can be further enhanced if the student is expected to master the content by repeating it until acceptable. Both aspects of improved motivation and mastery of core material are especially useful in a "service" physiology course for students in non-Biology programs. This paper describes the organization and management of such an individualized, mastery-based course. In essence, it is a flexible application of the Personalized System of Instruction ("Keller Plan"), Co-operative Learning and Peer-Directed Learning. Each element of the course is defined by specific objectives and these are grouped into modules. More than one instructional method is available to the student for each module and specific mastery criteria are published. Evaluation is continual and feedback is prompt. Students work at their own pace but an instructor-set pacing strategy and a tiered system of prerequisites curtail procrastination. If a module calls for practical work such as a lab exercise or a project, the element of individualized mastery is retained while at the same time peer collaboration is encouraged. This course format has proven to be an ideal vehicle for improving student motivation towards physiology and to develop decision-making problem-solving skills.

DESIGN INTERACTIVE SCIENCE SOFTWARE FOR YOUR OWN CLASSROOM

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Computer assisted instruction is, quite simply, an instance in which instructional content or activities are delivered via a computer. As Hannafin and Peck (1988) contend, "although the potential of CAI as an educational medium has been established and many effective educational courseware programs have been developed, much of the courseware currently available is deplorable". One way to insure that software is not only acceptable but also targets a specific class in a specific way is for instructors to design their own software. The Tutor Tech™ authoring system is a system that enables instructors, even instructors with minimal programming ability, to easily design their own hypermedia software programs. Tutor Tech, designed for the Apple II series, closely resembles the more advanced Hypercard™ program utilized with the MacIntosh computer. The instructor/designer utilizes the system's drawing tools and destination targets to actually design each individual frame and at the same time visually see what the frame looks like. The pull down menus enable graphics and sound to be incorporated into the program and a very simple one-line command will access cassette tape players and video disk players to add hypermedia to the presentation. College science instructors now have an easy method to teach, remediate, or even test individual classes or students.

WRITING TO LEARN IN ORGANIC CHEMISTRY

Harold W. Pier
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Utica College of Syracuse University
Utica, NY 13502

Instead of a text, students are given a set of lecture notes in outline form. All structures and drawings are prepared using the "CHEM DRAW" graphics program. Students write up the week's lectures, using the notes as a framework. The write-up is read by the professor or other students in the class and occasionally by students in an English composition class. The readers make comments on both chemistry and the clarity of the writing. The advantages of this system include more class interaction because students don't feel they have to be constantly taking notes. Also, students read the material several times, in outline, as they write it, and as critics. Knowing that the work will be reviewed and serving as critics make them more careful in their writing. I have read comments such as "I understand this material better now that I have read your journal" or "I wish I had said it that way". Although it is difficult to make a quantitative assessment, by spring of 1991 I will have data for scores on the ACS Organic Chemistry Exam to compare with those of previous years.

SUCCESSFUL APPROACHES TO TEACHING AN INTRODUCTORY SCIENCE COURSE -- NATURAL SCIENCE FOR TEACHERS: BIOLOGY

Angela M. Sauro
Biology Department
Mount Mary College
Milwaukee, WI 53222

Too much rote work, too many lectures, and beakersful of musty textbook experiments can be a formula to turn students off the subject of science. Just when understanding science and technology is increasingly important, many students are turned off by the subject. The Mount Mary College Biology Department faculty has designed a pre-service Natural Science for Teachers: Biology course which uses a variety of interactive and hands-on approaches to learning. The course uses a minimum of lecture; instead students are involved in projects, experiments, field trips, and computer use. Some emphasis is placed on the use of non-formal learning resources. Since the course stresses the processes of biological investigation the students were administered pre-post Processes of Biological Investigations (PBIT) GERMANN test in order to measure their ability to perform process skills. Six process areas are included: Hypothesis, Prediction, Assumption, Data and Hypothesis, Supporting Data and Evaluation. A general description of the course activities together with an analysis of the students outcomes as measured by PBIT will be presented.

EXTENDING INQUIRY-BASED INSTRUCTION TO THE LECTURE HALL: OPPORTUNITIES AND OBSTACLES

Douglas Schamel
Department of Biology and Wildlife
University of Alaska, Fairbanks
Fairbanks, AK 99775

At the Houston national convention, this panel presented ideas for energizing laboratory exercises, using the inquiry model. This year's presentation will show how lectures, too, can benefit from such an approach. "Inquiry" is fundamentally setting the instructional stage with a problem, question or puzzle which invites questions, discussions, investigation and possible solutions. Interesting beginnings to class meetings use demonstrations and/or discrepant events to engage students' minds and invite them to participate in the process of scientific discovery. Investigations may proceed in the format of a single large discussion group or many small problem-solving groups. Topics chosen should have some relevance to students. We will discuss several examples, including migration studies and dinosaur excavations. We will also demonstrate how computers can be employed during lecture time as excellent tools to facilitate problem-solving and hypothesis-testing, using empirical data drawn from the environmental sciences. After the inquiry session, the

SUCCESSFUL APPROACHES TO TEACHING AN INTRODUCTORY SCIENCE COURSE -- NATURAL SCIENCE FOR TEACHERS: BIOLOGY

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DINOSAURS: A CASE STUDY IN THE PHILOSOPHICAL ROOTS OF GOOD SCIENCE

Edward W. Scheer
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Rollins College
Winter Park, FL 32789

Reconstructions of the paleobiology of dinosaurs, their evolution and extinction challenge the ingenuity of paleontologists and other scientists. Highly creative hypotheses have been offered in attempts to explain how dinosaurs lived, changed, and died. Many explanations are non-falsifiable and therefore closer to science fiction than they are to good natural science. The thesis that will be developed and illustrated using dinosaurs states that an elementary knowledge of certain aspects of philosophy can make the study of natural science more precise and enjoyable. Student enjoyment, importantly a function of a teacher's enthusiasm, can be heightened further by using aesthetics to broaden development in the affective domain. Student development can be strengthened by applying two additional branches of philosophy: logic and epistemology. Karl Popper's criterion of falsifiability usefully limits what is knowable in natural science and will be used to select from multiple hypotheses those that deserve our further attention and analysis.

RELATIONSHIP BETWEEN STUDENTS' LEARNING STRATEGIES AND THEIR SUCCESS IN HUMAN ANATOMY

Mary Jo Fourier and Pegi Denton
Division of Science, Health Care and Math
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Three sections of human anatomy students (N=72) were the subjects in a preliminary study of the relationship between learning and study strategies or methods and success in human anatomy as measured by semester grades. These students were administered the LASSI, Learning and Study Strategies Inventory, which had been designed to gather information from students regarding not only their learning and study practices but also their attitudes. This presentation will discuss the procedures followed in the administration, self-scoring, interpretation of the student's profile, and recruitment of students for the College's Learning Strategies Program. This program provided intervention methods for those students appearing to be "at risk" on the basis of their profile. A short discussion of how this program works and its course offerings will be given. Results of this preliminary study will be presented which indicated that when either of two of the strategy courses were taken, semester grades were higher than those of students with similar profiles who did not avail themselves of the intervention courses suggested. On the basis of these results, a new course offering, entitled "Strategy for Human Anatomy", was offered for the first time during fall semester 1991.

TEACHING THE UNDERPREPARED SCIENCE STUDENT SCIENCE VOCABULARY

Stephen M. Gittleson
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One characteristic of an underprepared science student is a student who has trouble handling science vocabulary. Students with poor science vocabularies (and the usually associated spelling problems) are frustrated in taking good notes in lecture and in reading the text. In turn, there is little wonder that learning is impeded and interest in science flags. I have developed a science vocabulary builder plan based on learning a select group of word roots, prefixes and suffixes. Knowing 200 word elements and their meanings makes it easier to handle a larger vocabulary. Since word elements are used over and over again, an unfamiliar word with a familiar component encourages learning. For example, in the following words : anthropogenesis, anthropology and anthropomorphism, we see ANTHROP as a common element. ANTHROP means "man". Therefore, all of these words and 25 more containing the element ANTHROP listed in Stedman's Medical Dictionary are familiar. Knowledge of the word elements GENESIS and OLOGY defines anthropogenesis as a word describing something about the "origin" of man and anthropology as the "science" of man. In this presentation, I will show how science vocabulary can be enhanced as painlessly as possible using a variety of exercises.

IS COOPERATIVE LEARNING AN EFFECTIVE METHOD FOR TEACHING LABORATORY DESIGN SKILLS?

Ben Golden, Jerald Hendrix, Judith Mitchell and Pamela Rhyne
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Kennesaw State College
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A summer workshop for elementary and middle school science teachers, funded through an Eisenhower Plan Grant for the improvement of science instruction in Georgia, served as a vehicle for determining whether cooperative learning is an effective method for teaching laboratory design skills. The participants were randomly assigned to cooperative learning groups and, using structured worksheets, were asked to design laboratory activities to explain selected phenomena. Each participant agreed to have the group's activities video-taped and/or audio-recorded for later analysis. The originals of all group assignments, group assessments, participant self-assessments, and instructor assessments were kept for analysis. This report offers evidence that cooperative learning is effective in increasing the participant's understanding of laboratory design, in improving the quality of the designed activities as the course progressed, and in teaching the participants to individually design laboratory activities. This analysis also suggests marked increase in the participants' confidence and interest in designing laboratory experiences for their students.

COLLABORATIVE LEARNING IN INTRODUCTORY BIOLOGY

Terry L. Hufford
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Washington, DC 20052

Collaborative learning experience and other initiatives were introduced into an introductory biology course for science majors approximately three years ago. The impetus for these initiatives came from the need to address particular problems of minority students. Initial results form the basis of a recent publication in BioScience and provide the background for this presentation. Problems encountered in this year's class will be addressed and recommendations will be made for the establishment of effective collaborative learning experiences.

PROVIDING ACADEMIC SUPPORT FOR UNDERPREPARED BIOLOGY STUDENTS

Charles Lytle and William Surver
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North Carolina State University
Raleigh, NC 27695-7611

Many entering college students in recent years have demonstrated weak preparation in science and mathematics. Academic success in biology courses has become increasingly difficult for such students because of the greater emphasis on chemistry, physics, and mathematics. Modern biology has increasingly become analytical and quantitative rather than chiefly a descriptive science. Because of their poor performance in introductory science courses, underprepared students are often discouraged and excluded from potential careers in science, engineering, and related professions. More seriously, such students may develop or strengthen an aversion and/or a distrust for science. In this session we shall discuss and demonstrate academic support systems that have been developed at two large state universities, Clemson and North Carolina State, to improve the success of underprepared students in introductory biology courses. Research on the identification of high risk students, remediation attempts, and student responses will be discussed. We shall also review experiences with learning resource centers, use of videotape and videodisc learning aids, computer programs, voluntary pretests, and other academic support services.

LINKWAY™ APPLICATIONS FOR SCIENCE TEACHING

Kathryn Malone, Eileen Walsh, and Catherine DeSa
Departments of Biology and Chemistry
Westchester Community College
Valhalla, NY 10595

This paper will offer participants information and specific examples of how this IBM authoring system can be used in science classes. Both lecture and laboratory applications will be presented. Examples of use in biology and chemistry classes will be showcased. Stand-alone applications as well as combined computer/videodisc pairing will be discussed. Participants will be provided with basic data about the specifics of the Linkways program and how they can use it with minimal additional equipment to produce great instructional and tutorial materials.

INNOVATIONS IN UNDERGRADUATE PHYSIOLOGY LABORATORIES

Dee U. Silverthorn
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University of Texas
Austin, TX 78712

The traditional undergraduate physiology laboratory curriculum has not kept pace with the rapidly changing technology. The lab manuals currently available no longer fill the needs of many schools, since available equipment and instructional objectives vary widely. Students are not challenged by "cookbook" exercises in which they do not use independent thinking or problem-solving skills. Finally, there is a growing problem with the animal rights movement targeting the traditional vertebrate models used in the classic experiments. This paper will present some ideas which have been used at the University of Texas to overcome these problems. They include exercises which emphasize critical thinking and quantitative skills, which require students to design and execute experiments with the proper controls, and which use computers in the laboratory setting (currently available computer simulations/interactive software as well as statistics, graphics, and word-processing software) Alternative exercises use invertebrates instead of the classic vertebrate models. Information will be provided about a group of physiologists who are establishing a network to exchange innovative student laboratory experiments.

CONTENT AND PROCESS:
APPLICATION OF A CRITICAL THINKING MODEL TO SCIENCE INSTRUCTION

David J. Stroup
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Francis Marion College
Florence, SC 29501

Robert D. Allen
Victor Valley College
Victorville, CA 92392-9699

Current research dealing with higher order thinking skills has provided information that is beginning to alter how we approach science teaching. Recommendations for increased emphasis on thinking skills are both frequent and insistent. Science teaching, in particular, is devoting more attention to the need for teaching methods and strategies which can develop students' ability to think logically, analyze, and utilize basic concepts to draw conclusions and make predictions. Unfortunately, few effective models exist which can guide and assist science teachers in the development of more productive teaching methods. A model developed by Drs. Allen and Stroup which maintains a balance between teaching information content and higher order thinking skills will be presented. Critical and analytical thinking skills, case studies, and especially the difficulties and problems exhibited by students, will be illustrated with specific examples.

ABSTRACTS FROM AREA CONVENTIONS
RENO, NV

TEACHING ANIMAL PHYSIOLOGY FROM A PROBLEM-SOLVING PERSPECTIVE

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A problem solving (PS) orientation was used to instruct an upper division course, Principles of Animal Physiology, for zoology majors. The small, diverse student body (sophomores through doctoral students) offered a unique opportunity. A knowledge base was provided using a traditional lecture format, followed by problem scenarios that the students solved as a class. Weekly written problems were posed as individual assignments, with prompt feedback provided. For the weekly laboratory exercises, students were divided into small groups. Pre-lab assignments often required the group to propose an experimental plan, which was critiqued by the instructor, and then the procedures were carried out and the results presented to the class. Post-lab problems were also presented to each group for discussion, with subsequent submission of written answers for evaluation. Examinations included an average of 30% problem solving activities. Each student also wrote a paper reviewing the primary literature (since 1980) concerning a topic in physiology of their choice. Papers were submitted for initial evaluation by the instructor and returned to the student for revision prior to final evaluation. Given this opportunity to practice PS, the majority of students improved their PS skills. Based on written student evaluations, the students enjoyed the PS approach and felt more involved with the course content.

A DEGREE PROGRAM THAT IS TURNING STUDENTS ON TO SCIENCE

James Deacon and Roberta Williams
Department of Biological Sciences
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Las Vegas, NV 89154

A Bachelor of Arts degree in environmental studies recently initiated at the University of Nevada, Las Vegas, has resulted in renewed student interest in various fields of science. The program is designed to provide students with a general understanding of the environmental challenges facing our world, with the basic skills essential for success in a career in the environmental arena, and with depth of understanding in at least one area of emphasis. The course of study requires a "core" of courses aimed at developing basic skills and exposure to many fields of science (biology, chemistry and geography), plus considerable flexibility in defining an area of specialization. We are finding that many students are choosing one of the scientific fields for their area of emphasis and with this broad-based degree envision career possibilities in industry, government and business which would not be obtainable with a degree in a single science.

WRITING TO LEARN BIOLOGY

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Although writing is critical to a scientist's career, most scientists do not understand how to write effectively or use writing as a tool to learn. Moreover, many scientists think that writing 1) should be taught only in English classes, and 2) is unrelated to science. I contend that writing is thinking and that rewriting, the essence of effective writing, is rethinking. My program to improve students' writing and thinking is modelled after that presented in WRITING TO LEARN BIOLOGY (Saunders College Publishing). This program involves not only having students write, but teaching students to write effectively. The program simultaneously teaches writing, science, and thinking. We discuss 1) the role of writing in a scientist's career, 2) myths about writing, 3) the great writers of science, and 4) the different types of scientific writing. Each discussion includes assignments such as "take a side" essays, letters to the editor, analyses of data, and journal-writing. Students who have completed this program 1) do significantly better in subsequent courses than do students who've not completed the program, 2) write "better," as judged by grammar-checking and readability programs, and 3) often claim that their improved writing skills enhanced their learning and helped them get jobs.

TEACHER'S PROFESSIONAL DEVELOPMENT ACADEMY AT UNLV

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The Professional Development Academy has been offered for the last five years by the College of Mathematics, Science and Engineering. The purpose of the program is to strengthen skill and competence of teachers in Clark, Nye and Lincoln counties. During the school year, late afternoon weekly seminars on topics of interest to science teachers were offered. Summer school courses were directed to specific needs in mathematics, chemistry, physical science, and biology. This offered the opportunity for teachers from adjacent Nye and Lincoln counties to attend while living on the UNLV campus. Tuition, living expenses and instructors' salaries were funded by monies from the Eisenhower grant administered by the Nevada Chancellor's office.

TREATING NON-MAJORS FOR CHEMOPHOBIA

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For a variety of reasons, many college students avoid non-majors chemistry and instead opt for other science courses (mainly biology) to complete their science requirements for college graduation. They avoid college chemistry because of their perceived "fears", whether real or not. As their instructors, we have only one chance to put them on the side of science. If we, as chemistry instructors, address their "chemophobias" and its causes, we can get them to enroll in non-major chemistry courses. In surveys of my non-majors chemistry students, I have identified several of their main "chemophobias". Keeping these phobias in mind, I have adapted various teaching techniques to spark and keep their curiosity in chemistry. It is possible to rid them of most of their fears and to get them excited about chemistry as it relates to their life and future.

PEOPLE AND TECHNOLOGY: A LOVE STORY

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PEOPLE AND TECHNOLOGY: A LOVE STORY This seems an appropriate title for an interesting marriage of technology to history. How can such very different subjects be the basis of a course? At UNLV the course Engineering 100, People and Technology, does just that. Students start by examining protohumans and their initial attempts at modifying their environment using primitive technology. This leads to a study of customs and life styles. By the end of the course it is nuclear powered laser guided missiles and their continuing interaction with today's news, which is tomorrow's history that has become the topic. The course also looks at the development of science and the scientific method and examines the engineering process and the team of designers from thinkers to laborers. Special attention is paid to the North American historical experience which was heavily dependent on emerging capabilities in applications of physical science, first in sailing vessels, then canals, steam in boats and rails and mills, and on to assembly lines and electric power. Students receive non-lab science credit for students not in the sciences or engineering.

MASTERS OF ARTS IN SCIENCE: AN ATTEMPT TO SATISFY UNUSUAL NEEDS

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The College of Science and Mathematics at the University of Nevada, Las Vegas has proposed an interdisciplinary Master of Arts in Science degree program for students that need a broad based science degree. This non-thesis program will allow students to become proficient in two science fields or in mathematics and one field of science. The target population that this degree has been designed for is secondary science educators who often must teach more than one science. To earn the degree, students must take 33 graduate credits; 21 of those credits in one science and 12 in another science. Six of the 33 credits will be earned from a research project. The long range goal of this program is to increase science awareness in young people who might then be stimulated to pursue careers in science.

ABSTRACTS FROM AREA CONVENTIONS VANCOUVER, BC

PSYCHICS, MAGICIANS AND THE SCIENTIFIC METHOD

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Teaching the scientific method is often one of the more difficult and boring sections of an introductory science course. An effective approach of teaching can be to show the students what science is by showing them what science isn't. As counter examples to the scientific method, this presentation uses examples of simple magic tricks in the guise of psychic powers. These examples are then detailed to show how believers of such charlatan acts are acting unscientifically.

A SUMMARY OF RESEARCH ON INTRODUCTORY COLLEGE SCIENCE COURSES FOR NON-MAJORS, MAJORS, AND MIXED CLASSES

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College and university science departments may offer a single introductory course sequence that is designed to meet the needs of all students, or distinctions may be made between courses for declared science majors and non-majors. This paper presents a review of the literature concerning the real and perceived similarities and differences in these courses. The rationales that have been used for supporting or refuting the offering of different courses as well as for differences in course content, texts, and teaching approaches are discussed. Applicable research results are examined to see if there are any data that support the distinctions that are made between these courses.

HIGH IMPACT RETRAINING PROGRAM FOR PHYSICS AND CHEMISTRY TEACHERS

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This presentation will focus on the mechanics, structure, funding and goals of developing a highly successful retraining program for physics and chemistry teachers in Minnesota. Bemidji State University is currently completing a second three-year summer sequential program for secondary teachers. The project involves forty participants all of whom are experienced successful teachers who are seeking new licensure in these fields. The program has been fully subscribed each year with near zero attrition. The presentation will also include

(1) attracting desirable faculty
(2) attracting qualified participants
(3) evaluation techniques
(4) social functions
(5) multiple source funding
(6) continuation when the funding stops
(7) the institute as a recruitment device

Through this project, Bemidji State University, which is a very small school, will have effectively trained over 12% of the licensed physics and chemistry teachers in Minnesota within a six year period.
This paper was also presented at the New Orleans and Reno area conventions.

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